BEFORE THE SECRETARY OF THE INTERIOR

PETITION TO THE U.S. FISH AND WILDLIFE SERVICE TO PROTECT THE SAN GABRIEL CHESTNUT SNAIL UNDER THE ENDANGERED SPECIES ACT

CENTER FOR BIOLOGICAL DIVERSITY

Notice of Petition

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Petitioner

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 1.3 million members and supporters dedicated to the protection of endangered species and wild places. http://www.biologicaldiversity.org

Failure to grant the requested petition will adversely affect the aesthetic, recreational, commercial, research, and scientific interests of the petitioning organization's members and the people of the United States. Morally, aesthetically, recreationally, and commercially, the public shows increasing concern for wild ecosystems and for biodiversity in general.

November 13, 2017

Dear Mr. Zinke:

Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. §1533(b), Section 553(3) of the Administrative Procedures Act, 5 U.S.C. § 553(e), and 50 C.F.R. §424.14(a), the Center for Biological Diversity and Tierra Curry hereby formally petition the Secretary of the Interior, through the United States Fish and Wildlife Service ("FWS", "the Service") to list the San Gabriel chestnut snail (*Glyptostoma gabrielense*) as a threatened or endangered species under the Endangered Species Act and to designate critical habitat concurrently with listing. The U.S. Fish and Wildlife Service has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on FWS. Specifically, FWS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C §1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." Id. Petitioners need not demonstrate that listing is warranted, but instead petitioners must only present information demonstrating that such listing may be warranted. While the petitioners believe that the best scientific information demonstrates that listing is in fact warranted, it is clear based on the available information that listing the snail may be warranted. As such, FWS must promptly make an initial finding on the petition and commence a status review as required by 16 U.S.C §1533(b)(3)(B).

On behalf of all petitioners,

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EXECUTIVE SUMMARY

The San Gabriel chestnut snail (*Glyptostoma gabrielense* Pilsbry, 1938) is a glossy, rich brown terrestrial snail found only in the San Gabriel Mountains and foothills near Los Angeles, California. Due to specific habitat requirements and high levels of urban development, it has already been extirpated from most of its original range. Surviving populations face an array of threats including development, fire, climate change, and recreation. To safeguard remaining populations, this critically imperiled snail now needs protection under the Endangered Species Act. This petition reviews the scientific information that is available on this rare species, and then lays out the factors that threaten its survival demonstrating that no mechanisms are in place to ensure that it survives for future generations.

INTRODUCTION

Snails are underappreciated but highly important components of terrestrial ecosystems. They eat decaying vegetation and animal waste, recycle nutrients, disperse seeds and fungal spores, and build soils (Frest and Johannes 1997, p. 27). Because land snails can be detritivores, herbivores, and carnivores, they play an ecologically critical role in nutrient cycling (Sullivan 1997, p. 10). They have been described as “some of the tools nature employs for the essential tasks of cleaning and recycling” and lauded for their “function in maintaining the balance in nature” (Burke 2013, p. 13).

Snails provide food and calcium for many other animals including birds, amphibians, reptiles, mammals, and other invertebrates (Churchfield 1984, Martin 2000, p. 52; Astor 2014, Vendetti 2016). Empty snail shells are used as shelters and egg- laying sites by other invertebrates, and decaying shells return calcium to the soil (Jordan and Black 2012, p. 7). In fact, snail shells are the primary calcium source for some bird species; declines in snail abundance have been linked to eggshell defects, reduced reproductive success, and population declines in songbirds (Graveland et al. 1994, Graveland and van der Wal 1996). Because snails maintain moisture in their bodies, tiny species such as springtails and mites cling to them to obtain water (Burke 2013, p. 15).

Mollusks are useful as “indicator species” of the condition of an ecosystem because they are sensitive to habitat degradation and pollution (Frest and Johannes 1997, p. 29). They concentrate toxic chemicals in their soft body parts as a result of their trophic specializations and thus function as sensitive "biological indicator" organisms facilitating assessment of environmental conditions (Sullivan 1997, p. 10). They have small home ranges and do not disperse long distances, so they are particularly convenient for site-specific assessments of the environmental health of an area (Waggoner et al. 2006, p. 63).

Even though snails play such important roles in the environment, they receive very little conservation focus. Though invertebrates make up 99 percent of animal species richness, they receive far less conservation attention than vertebrates (Lunney and Ponder 1999, Regnier et al. 2009, p. 1215). Less than one percent of all described species of invertebrates have even been assessed to determine their conservation status, and most of these assessments have been made for the more charismatic groups of invertebrates such as butterflies, dragonflies, and corals (Regnier et al. 2015a, p. 7761).

Mollusks are the second largest phylum of animals on Earth, but because they are not as charismatic as other wildlife, they receive less conservation effort than they should receive given their high level of imperilment. Mollusks are the most at-risk group of animals because they are particularly vulnerable to changes in the environment brought about by humans (Regnier et al. 2009, p. 1214). Approximately 40 percent of recorded modern extinctions have been mollusks (Lydeard et al. 2004, p. 322; Regnier et al. 2015b, p. 2).

The International Union for Conservation of Nature (IUCN 2017) has assessed extinction risk for 2,183 species of air-breathing land snails and slugs (Order Stylommatophora) and determined that 182 species are extinct, 11 species are extinct in the wild, 39 species are possibly extinct, 227 species are critically endangered, 187 species are endangered, 339 species are vulnerable, and 250 species are near threatened, totaling a known imperilment rate of 57 percent. An additional 388 species are data deficient, so of the evaluated 2,183 species, only 27 percent are of least conservation concern. These numbers do not reflect the numerous species that have yet to be evaluated. Mollusk specialists estimate that twice as many mollusks are actually extinct than are currently ranked as extinct, demonstrating the urgent conservation gap facing this group of animals (Regnier et al. 2009, p. 1214; Regnier et al. 2015b, p. 2).

Within the continental United States, only 38 species of snails are listed as threatened or endangered under the Endangered Species Act. Of these, 11 are land snails. This low number is not an indication that populations are secure, but rather that land snails as a group are understudied and under-protected (Sullivan 1997, p. 9; Minton and Perez 2010). Though there is growing concern that many terrestrial gastropod species may be in decline, few research and conservation efforts have been undertaken for this group of obscure but important animals.

North America supports far fewer species of terrestrial gastropods than other continents, with there being an estimated 35,000 total terrestrial gastropod species globally, but only 1,128 known native species of terrestrial gastropods in the United States and Canada (Nekola 2014, p. 227, 230). Native North American land snails display a diversity of forms and are divided into 41 recognized taxonomic families; they range in size from 1.1 mm to 34 mm in diameter (Nekola 2014, p. 228).

In the western United States, many snail species evolved after becoming isolated by climatic and topographical barriers to dispersal and gene flow (Frest and Johannes 1997, p. 7; Sullivan 1997, p. 11; Burke 2013, p. 18). In southern California, many terrestrial snails now survive in isolated patches that are separated by inhospitable terrain. These snails are the descendants of species that were presumably more widespread in the Pleistocene and earlier when the climate was cooler and wetter (Betancourt et al. 1990, Goodward et al. 2017, p. 111). The now-isolated canyon and mountain habitats where snails have diversified are analogous to island habitats which have high extinction rates due to dispersal barriers and concentrated threats (Solem 1990, Hadfield et al. 1993, Chiba and Roy 2011). The San Gabriel chestnut snail is one such species, and is restricted to an "island" of habitat in the San Gabriel Mountains, part of the Transverse Ranges situated between the Los Angeles Basin and the Mojave Desert.

The plight of the San Gabriel chestnut snail reflects the larger troubling global picture of declining mollusk species, increasing habitat threats, and lack of detailed scientific knowledge at the level of individual species. Though there are many knowledge gaps concerning this snail, it is apparent that it has undergone significant range reduction and that its survival is threatened by development, climate change, fire, and lack of conservation planning for its remaining habitat. The San Gabriel chestnut snail needs Endangered Species Act protection and site-specific management to ensure its survival.

NATURAL HISTORY

Description and Taxonomy

The San Gabriel chestnut snail is dark chestnut brown in color and the shell is "highly polished" with a "brilliant" gloss (Pilsbry 1939, p. 567, 573). It grows to be 14 mm in height and 30 mm in diameter (Nekola 2014, supplemental materials p. 9).

The San Gabriel chestnut was described as a species in 1938 by the eminent malacologist Henry Pilsbry who described its distinctive morphological features, including the anatomy of the genitalia which are used to differentiate among mollusk species:

> *Glyptostoma gabrielense*, new species. Shell smaller than *newberryanum*, bay or chestnut colored, the surface highly polished, with scarcely any trace of spiral sculpture. The periphery, while not to be called subangular, is less equably rounded than in typical newberryanum. In a half dozen opened there were no internal septa. Height 13.7 mm., diam. 30 mm.; 5 1/2 whorls. Milliard canyon. Height 14.1 mm., diam. 29.3 mm.; 5 ½ whorls. Mt. Lowe. Height 14.2 mm., diam. 30.7 mm.; 5 1/2 whorls. Mt. Lowe. Penis and accessory sac of oviduct relatively much shorter than in *G. newberryanum*, the penis being about one-third the diameter of the shell, and the accessory sac of the vagina from one-fifth to one-seventh. Distribution: San Gabriel range back of Pasadena and on Mt. Lowe, type 97748 A.N.S.P. (Pilsbry 1938, p. 25).

The San Gabriel chestnut snail is taxonomically rare and is thus of high significance from a natural history standpoint as there are only two species in the genus Glyptostoma- the San Gabriel chestnut and the San Diego chestnut snail, *G. newberryanum* (Pilsbry 1948).

Snails in this genus are terrestrial and air-breathing and are differentiated from other land snails by their gastric pouch, which is separated from the gastric crop by a constriction, and by the pleural ganglia which are close to the pedal ganglia (Tillier 1989, p. 225). In his dissertation on the phylogeny of North American land snails, Webb (1960) includes detailed drawings of the genitalia of *G. gabrielense* with specifics on differentiating characteristics.

The San Gabriel chestnut snail is in the family Megomphicidae, in which there are only eight known living species, all occurring in western North America between Montana and northern Baja California, Mexico (Roth in Perez and Codeiro 2008, p. 37). Their shells are medium-sized, many-whorled, and are wider than they are high with a very flattened disk-like shape (Roth in Perez and Coderio 2008, p. 37). Most of the members of Megomphicidae have restricted ranges, some of them being known from only a few localities.

The San Gabriel chestnut is recognized as a valid species (Turgeon et al. 1998); its Integrated Taxonomic Information System serial number is 77419 (ITIS 2017).

Range and Distribution

Pilsbry (1939) described the San Gabriel chestnut's distribution as the San Gabriel Range within Pasadena, Millard Canyon, Mt. Lowe, and the Dominguez Hills (p. 573); the Dominguez Hills are small hills (approximately 200 feet above sea level) located about 6 miles north of Wilmington and Long Beach. The San Gabriel chestnut is included in Clench and Turner's 1962 catalogue of mollusk species named by H.A. Pilsbry (in 1938) and the range is described as the San Gabriel Range, back of Pasadena, California (p. 55).

Contemporary distribution data have been collected by the Los Angeles County Natural History Museum which runs a citizen-science project called Snails and slugs Living in Metropolitan Environments (SLIME) that aims to catalogue the biodiversity of terrestrial gastropods in Southern California (see: https://nhm.org/site/activities-programs/citizen-science/slime). SLIME localities where live specimens or empty shells of the San Gabriel chestnut have been found include: Eaton Canyon Falls Trail; Altadena Fish Canyon Falls Trail; Arcadia Gabrielino Trail to Sturtevant Falls; Angeles National Forest Lower Winter Creek Trail; Monrovia Canyon Park; Mount Wilson Trail; Sierra Madre South Hills Park (personal communication from Cedric Lee to Tierra Curry January 3, 2017; see Figure 1).

Population Status and Trend

The San Gabriel chestnut snail was first described as endangered more than 40 years ago in a review of western land snails when Smith (1970) categorized it as "endangered from development" in the Dominguez Hills (p. 43). He described it as "localized and rare" (p. 43). The Dominguez Hills population is now considered to be extirpated (Courtney 2016, p. 2).

The San Gabriel chestnut is listed by the California Natural Diversity Database on the "Special Animals List" (CDFW 2016). It is ranked as imperiled (G2S2) by NatureServe (2017), but this status was last reviewed in 2002 and needs to be updated; Magney (2016) recommends ranking it as critically imperiled (G1S1). Though no specific abundance data are available, it is apparent that historical populations have been lost to urban development when historically known sites are layered onto a contemporary map (Figure 1).

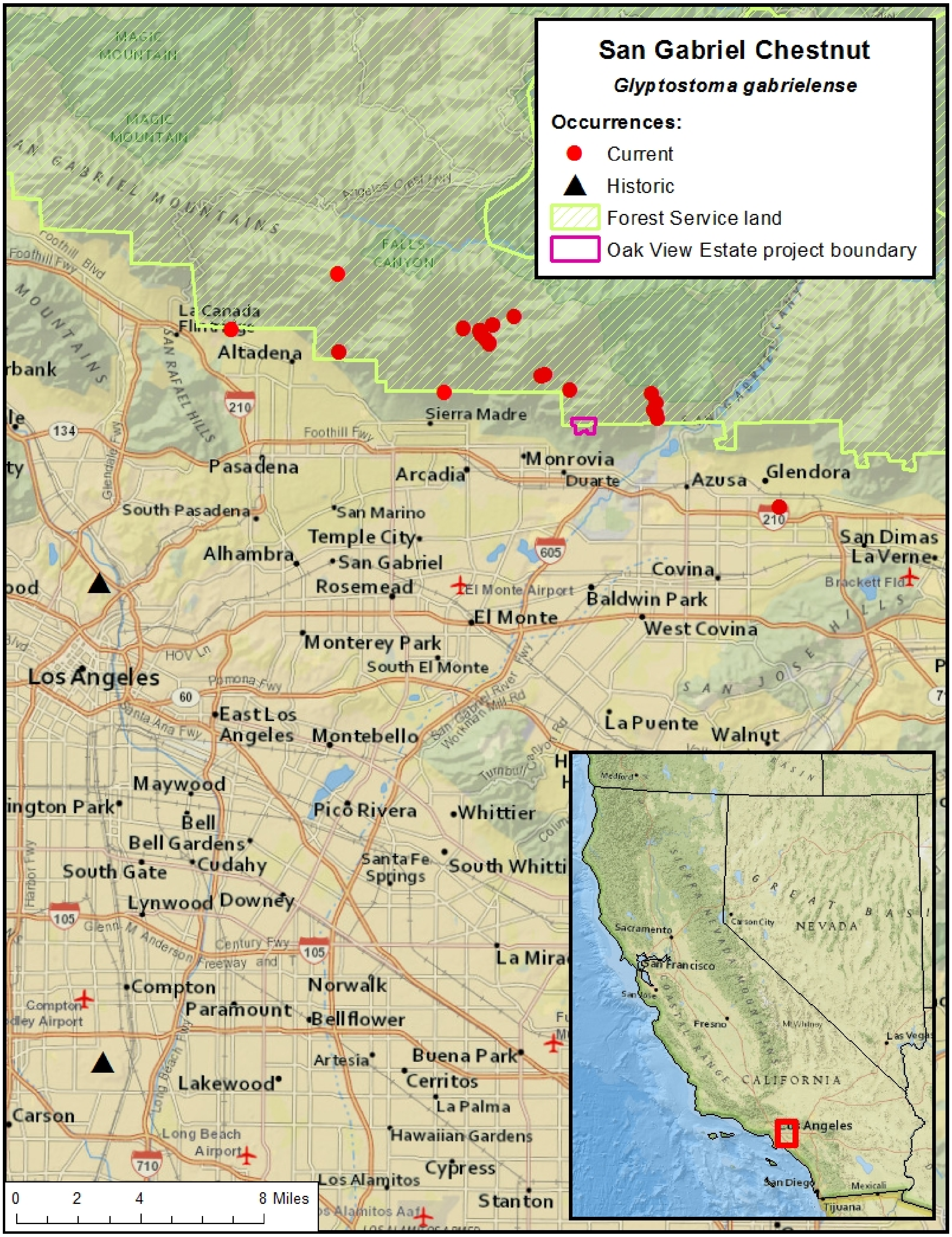

Figure 1. Historical and current San Gabriel chestnut snail populations. The snail is largely extirpated from developed areas with most known occurrences now confined to the Angeles National Forest and adjacent foothills.

Habitat

Water is a critical limiting factor for the survival and reproduction of gastropods (Burke 2013, p. 15). Terrestrial gastropods are hydrophilic and have permeable skin so snails in arid zones exhibit behavioral, physiological, and morphological adaptations to minimize the risk of dehydration (Moreno-Rueda 2012). Regardless of habitat type, desiccation is the primary reason for land snail mortality even in undisturbed habitats (Frest and Johannes 1997, p. 25). Terrestrial snails are thus limited to microhabitats with sufficient moisture and are largely sedentary, usually moving only to find food or reproduce; populations generally have low self-dispersal rates (Cordeiro 2004).

Pilsbry (1939) described the habitat of the San Gabriel chestnut as “humid spots in a semiarid country” in rocky hills and mountains at relatively low elevations (p. 567). He reported that snails were found under dead cacti and under vegetable debris (p. 573).

Vendetti (2016) describes the San Gabriel Chestnut’s habitat as under logs, cactus, and rocks.

Cox (1982) describes the habitat of *Glyptostoma newberryanum* (the most closely related species) as piles of weathered rock: the snails surface during moist conditions, but during dry seasons they move below the rock piles to the soil in order to stay moist, and the snails are found in different depths of the rock piles depending on moisture conditions (p. 9).

Perez and Cordeiro (2008) describe *Glyptostoma* habitat as rocky hillsides under plant debris, in rock piles, wood rat nests, and spaces beneath logs, stumps, and boulders (p. 37).

Activity of land snails is influenced primarily by moisture and temperature (Wiesenborn 2003, p. 205). In a microhabitat preference study of the white desert snail (*Eremarionta immaculata*), a species endemic to California’s Riverside Mountains, Wiesenborn (2003) found that active snails on the surface following rain preferred epiphyta (lichen and moss) as a substrate compared with other types of substrate (plant detritus and four size-classes of rocks) (p. 206). Lichen and moss might provide active snails with food or with a moister surface, increasing water absorption.

Surveying for desert snails is difficult because they aestivate underground during dry seasons. Wiesenborn (2000) suggests sampling for exposed shell remains as a simpler method of examining the distribution of desert snail populations (p. 451).

Diet

Glyptostoma snails eat decomposing plant tissue such as dead leaves and decomposing stems of herbaceous plants, and also consume the fungi and bacteria involved in the decomposition process (Cox 1982, p. 10).

Reproduction

San Gabriel chestnut snails mate face-to-face and are hermaphroditic with reciprocal sperm exchange (Jordaens et al. 2009, p. 306, 309).

Cox (1982) describes some details of the reproduction of the San Gabriel chestnut's closest relative, the San Diego chestnut (*Glyptostoma newberryanum*). Because *G. newberryanum* is the closest relative of *G. gabrielense*, their life history traits are likely quite similar. Cox describes the eggs as opaque milky white spheres with a tough flexible shell buried in the damp soil of a rodent tunnel deep within a rock pile in a clutch of six (p. 10). Newly hatched snails have a thin almost transparent shell and remain in the most sheltered parts of rock piles. Cox speculates that the San Diego chestnut may display annual growth lines and may survive for up to 30 years with most energy spent on egg production in later years (p. 10).

Due to long length of time to sexual maturity and low reproductive rate, population recovery following catastrophic events is slow (Hertz 1993, p. 65).

ENDANGERED SPECIES ACT PROTECTION IS WARRANTED

The Endangered Species Act states that a species shall be determined to be endangered or threatened based on any one of five factors (16 U.S.C. § 1533 (a)(1)). The San Gabriel chestnut snail is threatened by at least three of these factors and thus qualifies for federal protection. The best available information indicates that the snail is threatened by modification or curtailment of habitat or range, other factors that diminish its chance for continued existence including climate change, and lack of existing regulatory mechanisms to protect it from these threats.

THREATS

Modification or Curtailment of Habitat or Range

Overview

Endemic terrestrial snails are particularly vulnerable to habitat loss and degradation due to restrictive microhabitat requirements, patchy distribution, population isolation, small effective population sizes, and sensitivity to a variety of disturbances; loss and fragmentation of habitat can result in population extirpation and eventual extinction of the species as a whole (Sullivan 1997, p. 25-26). Land snails are threatened by any number of activities that result in surface disturbances such as construction of roads or facilities, installation of utilities, power-lines, and corridors, or other actions that modify physical features of the local landscape. These activities can have devastating adverse effects on small populations of terrestrial gastropods because of their dependence on moist leaf-litter and talus microhabitats. Effects of surface disturbance range from direct mortality and permanent loss of habitat to increasing fragmentation due to edge effects such as increasing soil aridity (Sullivan 1997, p. 30). Habitat fragmentation increases the distance between subpopulations and alters meta-population structure because land snails have low vagility. As essential habitat for populations is eliminated, effective population size is decreased and dispersal distances are increased, diminishing the species' resiliency and long-term viability (Sullivan 1997, p. 32). The primary threats to the habitat of the San Gabriel chestnut snail are urban development, fire, vegetation management, recreation, and air pollution.

Urban Development

Development generally makes irreversible changes to the landscape, destroying and fragmenting natural habitat and increasing pollution. Urbanization is known to reduce the diversity and abundance of native plant and animal communities and can lead to the extinction of endemic species (Hamer and McDonnell 2009, p. 568).

Urban development poses a high magnitude and imminent threat to the San Gabriel chestnut snail. Habitat loss and fragmentation is a leading cause of the decline of terrestrial mollusks because they have low dispersal ability which causes populations to become isolated following habitat disturbance (Edworthy et al. 2012, p. 875). Roads and other features of the developed environment create impassable barriers for terrestrial snails (Baur and Baur 1990, p. 613; Meadows 2002, p. 379; Edworthy et al. 2012, p. 882)

The San Gabriel chestnut is known to have been lost from two historic sites in Los Angeles County, the Dominguez Hills and Elysian Park, due to urban development. As natural habitat areas were converted to modern day Los Angeles, other populations would also have been eradicated, though this loss was not recorded.

There are very few surviving populations of the snail on private lands as the vast majority of populations are now concentrated in a narrow band on the Angeles National Forest northeast of Los Angeles and in the urban-wildland interface between the city and the forest (Figure 1). The urban wildland interface between the Angeles National Forest and the surrounding metropolitan area has been continually expanding in recent decades and loss of natural habitat is expected to continue (Jones et al. 2008). There are no measures in place to adequately protect remaining populations of the snail from development.

The San Gabriel chestnut is immediately threatened by the proposed Oak View Estates Development in the City of Bradbury in Los Angeles County. The development is located approximately 1.5 miles north of the Foothill Freeway (I-210) adjacent to the Bradbury Debris Basin, bordering the San Gabriel National Monument to the North. The 197-acre development would directly impact 49-acres to construct five estate homes, a private park, a water tank, fuel modification, and associated facilities such as roads, street landscaping, drainage, a debris basin, slopes and slope benches, and other infrastructure. Residential estate lots would be created by lowering the existing mountain located at the southwest corner of the site, and filling the stream within Bliss Canyon with fill material (Courtney 2016, p. 2). The California Department of Fish and Wildlife (CDFW) determined in March 2016 that the project impact area includes habitat for the San Gabriel chestnut snail (Courtney 2016, p. 2). CDFW determined that impacts to the snail appear to be immitigable (Courtney 2016, p. 2).

Air Pollution

Air quality in the Los Angeles Air Basin has declined over the last century due to urbanization. Riddell et al. (2011) compared the community composition of lichen species in southern California's national forests over several decades and found that species that are sensitive to air pollution have declined significantly. Fenn et al. (2006) looked at levels of soil acidification in mountains near Los Angeles resulting from air pollution and found that some soils have acidified by as much as two pH units since the 1980s. In a survey of chaparral soils in the Angeles National Forest in 1973, pH values generally ranged from 6.3 to 7.3, but in surveys in 1990 values in the same region were generally within the range of pH 4.6 to 5.7 (Fenn et al. 2006, p. 8). No studies have been conducted specifically on the response of the San Gabriel chestnut snail to contaminants from air pollution, soil pollution, or acidification, but as a group terrestrial snails are harmed by contaminants and acidification. Pollution affects the diversity, abundance, and individual quality of land snails (Eeva et al. 2010, p. 4165). Acidification reduces the amount of available calcium in the soil which causes decline in both snail abundance and in turn harms the bird species that prey upon snails (Graveland et al. 1994, Gardenfors et al. 1995, Pabian and Brittingham 2007).

Fire

Environmental factors including fire, drought, drowning, and mechanical injury are all known causes of mortality to terrestrial snails. Fires can kill thousands of snails in a single burn (Burke 2013, p. 18). Fires occurred in known habitat of the San Gabriel chestnut snail in 1980, 1985, 1993, 2008, 2009, and 2016 (Figure 2).

Most surviving populations of the San Gabriel chestnut snail are found on the Angeles National Forest and the vegetation of the area is highly prone to fire (Schaaf et al. 2004, p. 514). The extremely flammable vegetation of Los Angeles County combined with the annual Santa Ana winds and low levels of humidity combine to create very severe fire risk (Xu and Schoenberg 2011, p. 684).

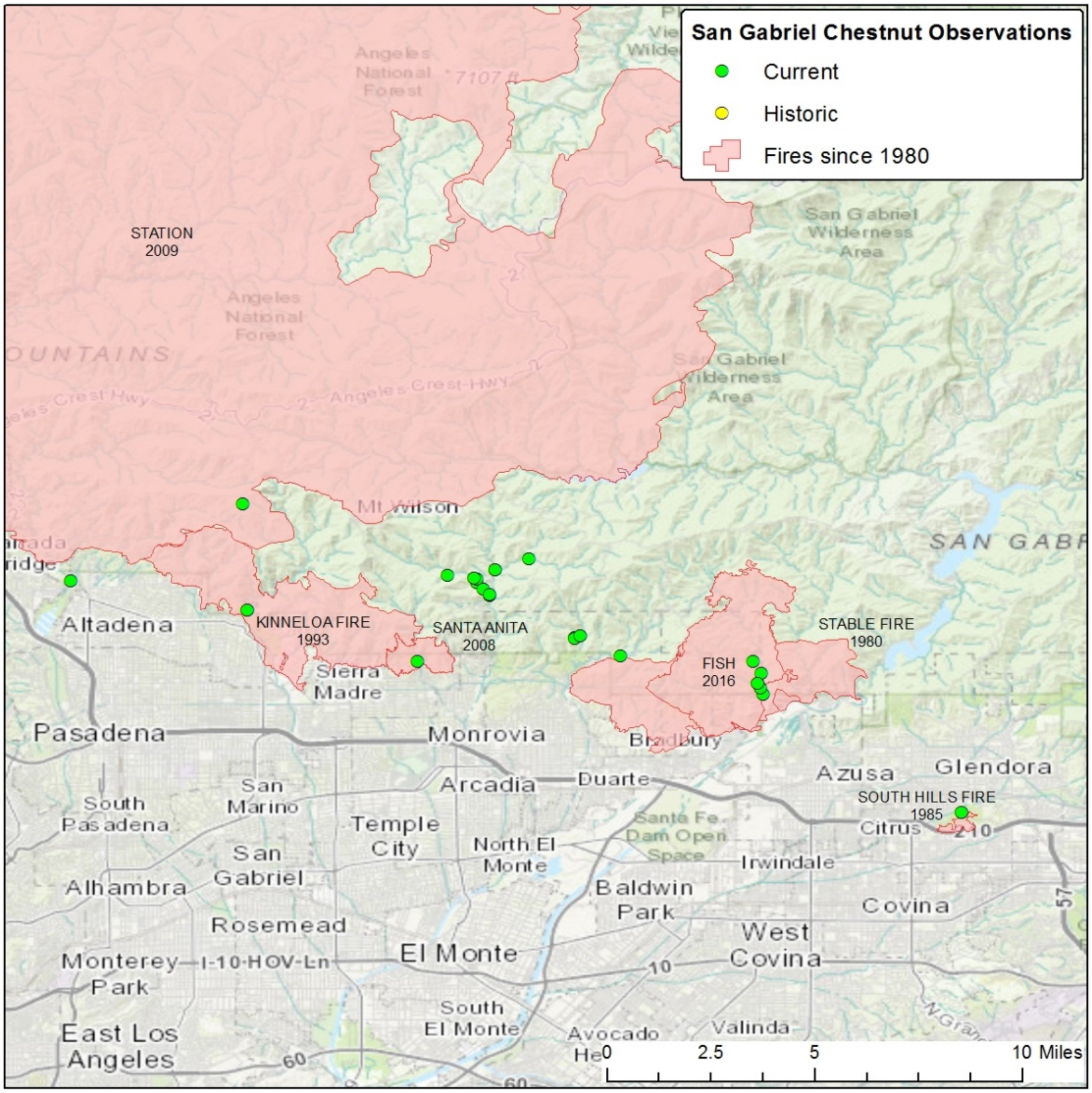

Figure 2. Fires since 1980 in the remaining habitat of the San Gabriel chestnut snail.

The Forest Service has identified wildland fire as a critical issue on the four southern California national forests including the Angeles (USDA Forest Service 2005, p. 11). From 1970 through 1998, a total of 4,439 fires consumed 142,379 hectares of chaparral and other vegetation within the Angeles National Forest, with a median fire size of 0.04 hectares and a maximum fire size of 19,179 hectares (Schaaf et al. 2004, p. 516). Numerous additional large fires have occurred since that time including in 2003, 2007, 2009 (Petersen and Wellstead 2014, p. 1), and again in 2016.

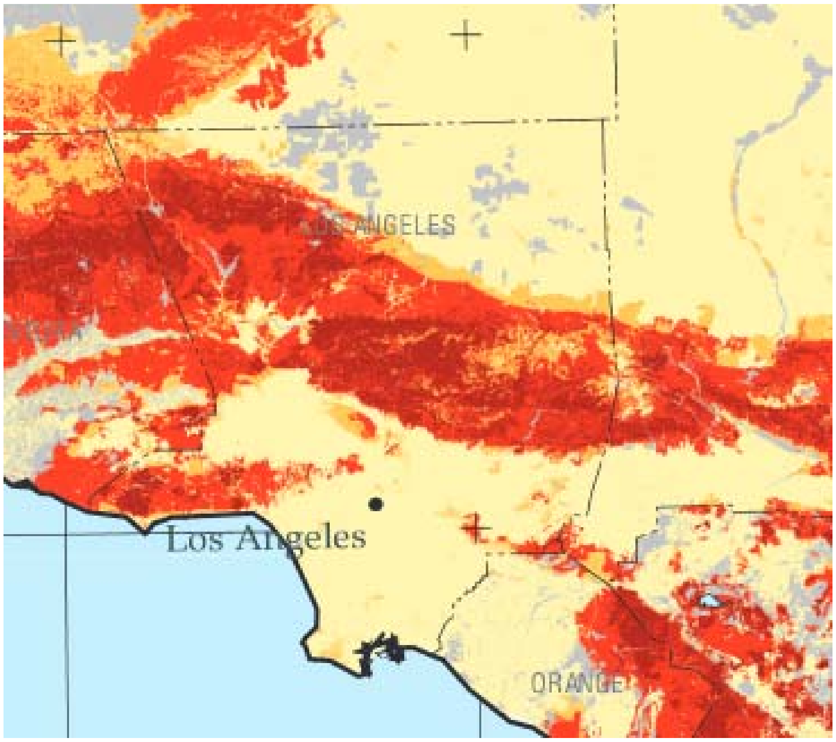

Figure 3. Los Angeles County Fire Threat Zones. The entire range of the San Gabriel chestnut snail is categorized as being under moderate (lighter yellow color) to extreme (darkest red) fire threat. The majority of the snail's remaining locations are on the Angeles National Forest in "extreme" fire threat zones. Excerpt from California statewide fire threat map. Available at: http://frap.fire.ca.gov/data/frapgismaps/pdfs/fthreat_map.pdf Accessed September 18, 2017.

In the Angeles National Forest, fire frequencies are currently greater than they were in pre-settlement conditions (Safford and Van de Water 2014, p. 21). Increasing fire frequency in southern California is strongly correlated with human population growth (Keeley and Fotheringham 2001, Syphard et al. 2007). Interactions between human populations and highly flammable vegetation types like coastal sage scrub and chaparral have led to major changes in fire regimes in and around southern California's suburban areas. Landscapes characterized originally by dense native shrublands have been converted to degraded, open stands of shrubs and exotic annual grasses and forbs, which are easily reignited.

The San Gabriel chestnut could be harmed directly by fire and also indirectly due to vegetation changes, altered soil conditions including moisture, temperature, and pH changes, erosion, landslides, floods, toxins, and the spread of non-native plant and animal species following fire. Fire induced changes in vegetation lead to higher rates of erosion, increased exotic species invasion, and higher fire hazard as grass fuels replace shrubs (Wells 1987, Zedler et al. 1983). Both fire and fire treatment lead to increased exotic vegetation (Merriam et al. 2006).

Fire in snail habitat may reduce shade-providing canopy vegetation, reduce the quantity of leaf mold and herbaceous plants, and degrade existing woody debris (Burke et al. 1999, pdf p. 14). Substances applied in forests in relation to fire control and management including chemicals, fertilizers, herbicides, and pesticides may be directly toxic to land snails (Burke et al. 1999, pdf p. 13).

Concerning the long-term effects of fire on the terrestrial gastropod community, Burke et al. (1999) state:

> Once extirpated from a site, populations of most gastropods are slow to recover. Fire is very destructive to snails and slugs, not only killing them outright, but in its destruction of logs and other woody debris which hold moisture and create microsites necessary for survival of these animals (Applegarth, 1995; Burke, personal observations). Sites that appear to be suitable habitat for many gastropods, but which have been burned in the past, support few if any species or individuals even after 50 years and longer (p. 60).

Bros et al. (2011) found that fire exerts a major impact on the snail community in Mediterranean forests, strongly reducing diversity and species richness (p. 611). Nekola (2002) found that high fire frequency negatively impacts snail diversity and abundance in grasslands.

Ray and Bergey (2015) found that terrestrial snails are especially susceptible to mortality from woodland fires. Snail loss occurs directly from burns, and also occurs post-burn because of altered habitat conditions, with snails that survive fires experiencing high post-burn mortality due to desiccation and reduced food supply (Ray and Bergey 2015, p. 44, 48). Land snails are highly vulnerable to drying out, and burning produces a warmer, drier habitat with reduced moist refuges by reducing leaf litter and exposing more soil to drying (Ray and Bergey 2015, p. 48). Changes in the microclimate at the soil-litter interface can cause severe mortality in snails (Sullivan 1997, p. 24). Drought exacerbates the negative impacts of fire on land snails (Ray and Bergey 2015, p. 48).

Landslides and rock fall events related to wildfires further threaten the San Gabriel chestnut and its habitat. Wildfires are a major destabilizing factor for soils in southern California as burn sites are more prone to landslides than vegetated slopes (Ren et al. 2011, p. 327). Scientific models predict that the combination of severe drought and the likelihood of more frequent and intense wildfires will lead to more intense landslides and devastating mudslides in the mountains of Southern California including in the San Gabriel's (Ren et al. 2011, p. 327). Major landslides occurred in 2008, 2009, and 2010 following intense fire events (Ren et al. 2011, p. 338; de Graff and Gallegos 2012, p. 389). Rock slides can persist within and downslope from burned areas for weeks and months following a fire event (de Graff and Gallegos 2012, p. 389).

Soils in chaparral areas are commonly repellent to absorbing water, and this repellency increases after fires (Hubbert et al. 2008, 2012). Increased repellency contributes to runoff and decreased soil moisture, both of which are harmful to terrestrial snails.

The snail could also potentially be harmed by fire suppression efforts including chemical extinguishers and by extensive vegetation removal to reduce fire risk.

A further threat to the snail from fires is exposure to fire-released toxins. Wildfires release heavy metals into the environment (Rothenberg et al. 2010, Burke et al. 2013, Odigie and Flegal 2014) and snails are particularly sensitive to metal contaminants, so much so that they are commonly used in assays to test contamination levels (de Vaufleury and Pihan 2000, Regoli et al. 2006, Ansaldo et al. 2009, Coeurdassier et al. 2010, Gimbert et al. 2016).

Vegetation Management

The San Gabriel chestnut snail is threatened by vegetation management activities and other projects on the Angeles National Forest. Because the snail is not designated as a "Sensitive Species" by the U.S. Forest Service, no survey or other management requirements are in place to safeguard its habitat during operations. For example, in 2010 a fuel removal logging project was completed directly in the habitat of the San Gabriel chestnut snail and no measures were undertaken to protect the snail and no post-project monitoring occurred to document impacts (Figure 4).

Timbering and other forms of vegetation removal are known to be harmful to terrestrial snails. Any modification of habitat that decreases soil moisture or increases soil temperature is very strongly detrimental to land mollusks (Frest and Johannes 1997, p. 37). Logging tends to increase the amount of solar radiation reaching the ground to the point that most mollusks in the project area are extirpated, and then the burning of slash, physical disruption of habitat, destruction of forage plants, and spraying of herbicides and pesticides exacerbates the level of habitat degradation for land snails (Frest and Johannes 1997, p. 37-38).

Summing up the harmful effects of logging projects on terrestrial mollusks, Frest and Johannes (1997) state:

> Lumbering increases insolation; removes cover; increases ground temperature in summer; decreases effective ground temperature in winter (i.e., increases exposure); decreases available moisture and effective humidity; removes shelter, hibernation, and egg-laying sites; removes ground cover, including forage plants for many species; simplifies community structure; and decreases diversity. The removal of coarse woody debris and litter by logging (often followed by burning of slash) is particularly objectionable (p. 39).

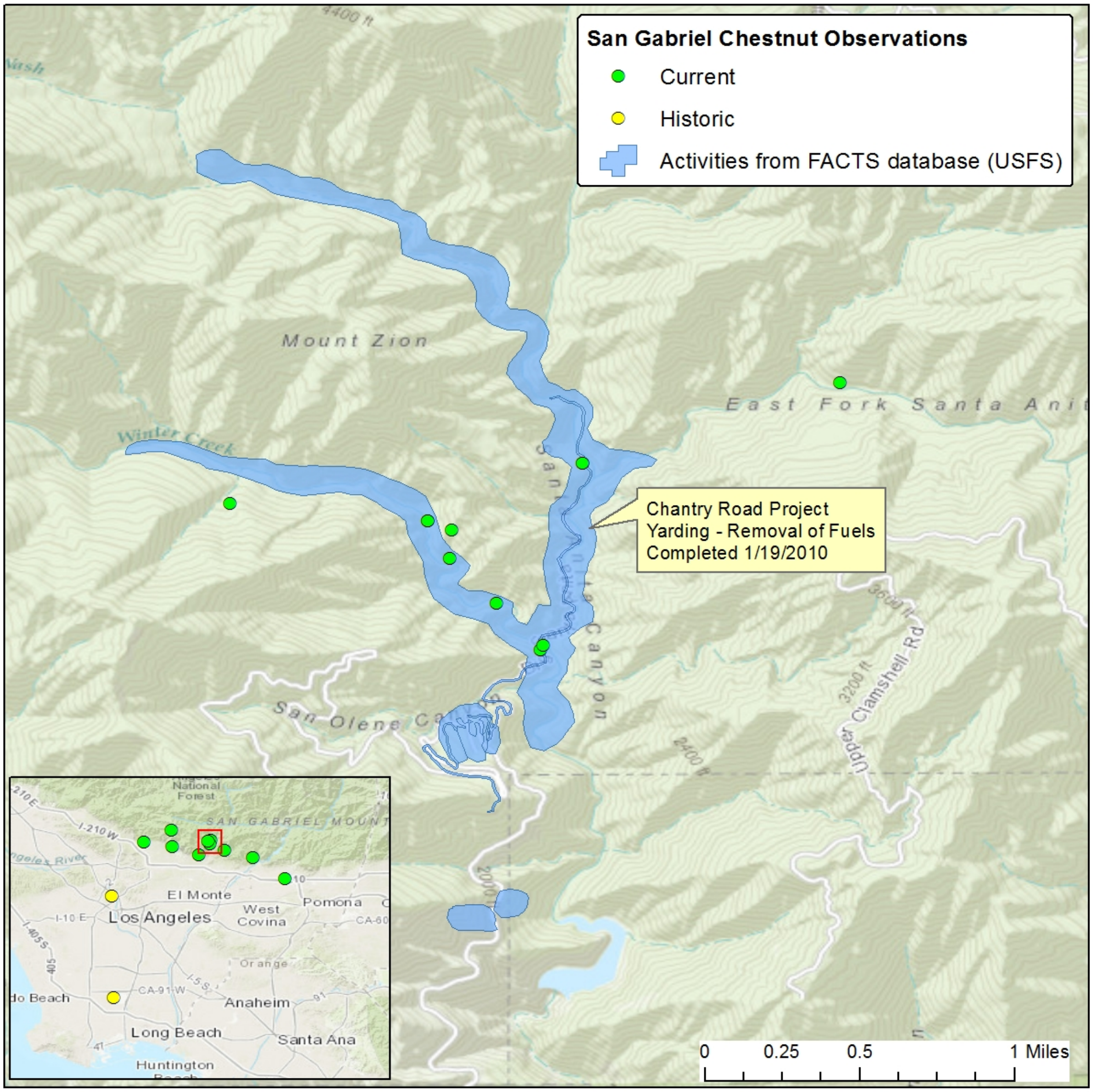

Figure 4. U.S. Forest Service vegetation management project conducted directly in the habitat of the San Gabriel chestnut snail on the Angeles National Forest with no protective measures in place to survey or manage its habitat

In a study on the effects of logging on land snail diversity in western Washington, Frest and Johannes (1997) found that relatively undisturbed sites had a mean diversity of 10-12 species, but recently clear-cut areas generally had no mollusk species; even 20 to 60 years after clear-cutting, most sites regained no more than two mollusk species (p. 37). They conclude, "Often, the only mollusks seen alive in recent clear-cuts were found in very limited colonies under protected settings as missed trees or unburned debris piles. In our opinion, the long-term viability of such colonies is questionable, let alone their ability to serve as reservoirs to repopulate regrown forests" (p. 37).

Roads

Road construction can cause directly mortality of snails, degrade snail habitat in multiple ways, and create barriers to dispersal that permanently alter the genetic structure of populations (Frest and Johannes 1997, p. 44). Roads facilitate the spread of invasive species, cause soil erosion, foster pollution, and create edge effects into adjacent habitat resulting in altered microclimates (Meadows 2002, p. 377). For tiny, non-vagile species like terrestrial snails, trails can create similar effects (Meadows 2002, p. 377). Application of herbicides in roadway and trail maintenance can also harm terrestrial snails (Frest and Johannes 1997, p. 44).

Recreation

Recreation can degrade habitat quality for wildlife in numerous ways including pollution from vehicles, trampling of flora and fauna, soil compaction, dust and erosion from roads and trails, removal of firewood and other desirable vegetation, spread of invasive species, littering, etc. (Speight 1973, Liddle 1975, White and Bratton 1980, p. 248). Recreation can harm snails via several mechanisms ranging from direct trampling to creating dispersal barriers and degrading habitat conditions. Mechanical injury from vehicles, equipment, and trampling by feet are documented causes of mortality for terrestrial snails (Burke 2013, p. 19). Because snails move following microhabitat cues such as moisture, vegetation, and downed leaves, both paved and unpaved roads and trails can act as dispersal barriers that isolate snail populations (Baur and Baur 1990, p. 613; Meadows 2002, p. 379).

Few specific studies of recreational impacts on snails have been undertaken, but the studies that have been conducted reveal negative effects. Kalisz and Powell (2003) found that land snails can be affected by dust from forest roads (p. 177). McMillan et al. (2003) found that terrestrial snail density, richness, and diversity were lower along rock climbing routes than in unclimbed areas and that rock climbing has significant negative effects on the land snail community (p. 616). Frest and Johannes (1997) report that hiking trail construction, maintenance, and use, and heavy use of picnic areas can extirpate snail colonies (p. 44).

Due to heavy visitation pressure on the Angeles National Forest, millions of visitors recreate in the snail's habitat but no measures are in place to protect it from trampling or habitat degradation. Figure 5 shows campgrounds, trails, and picnic areas in the San Gabriel chestnut snail's habitat. Approximately 31 million people live near, visit or influence the Angeles, Cleveland, Los Padres, or San Bernardino National Forests, and most are within a one-hour driving time from the national forests (USDA Forest Service 2005, p. 8). Common recreational uses on the Angeles National Forest include camping, hiking, rock climbing, swimming, boating, picnicking, barbecuing, sightseeing, skiing, biking, horseback riding, and off-highway vehicle use (Chavez and Olson 2008, p. 65). Recreational pressures on national forests are expected to increase into the future with ongoing human population growth (English et al. 2014, p. 16). Population growth in southern California is expected to increasingly encroach upon wildland areas, negatively affecting water, air, open space, and endangered species (Struglia and Winter 2002).

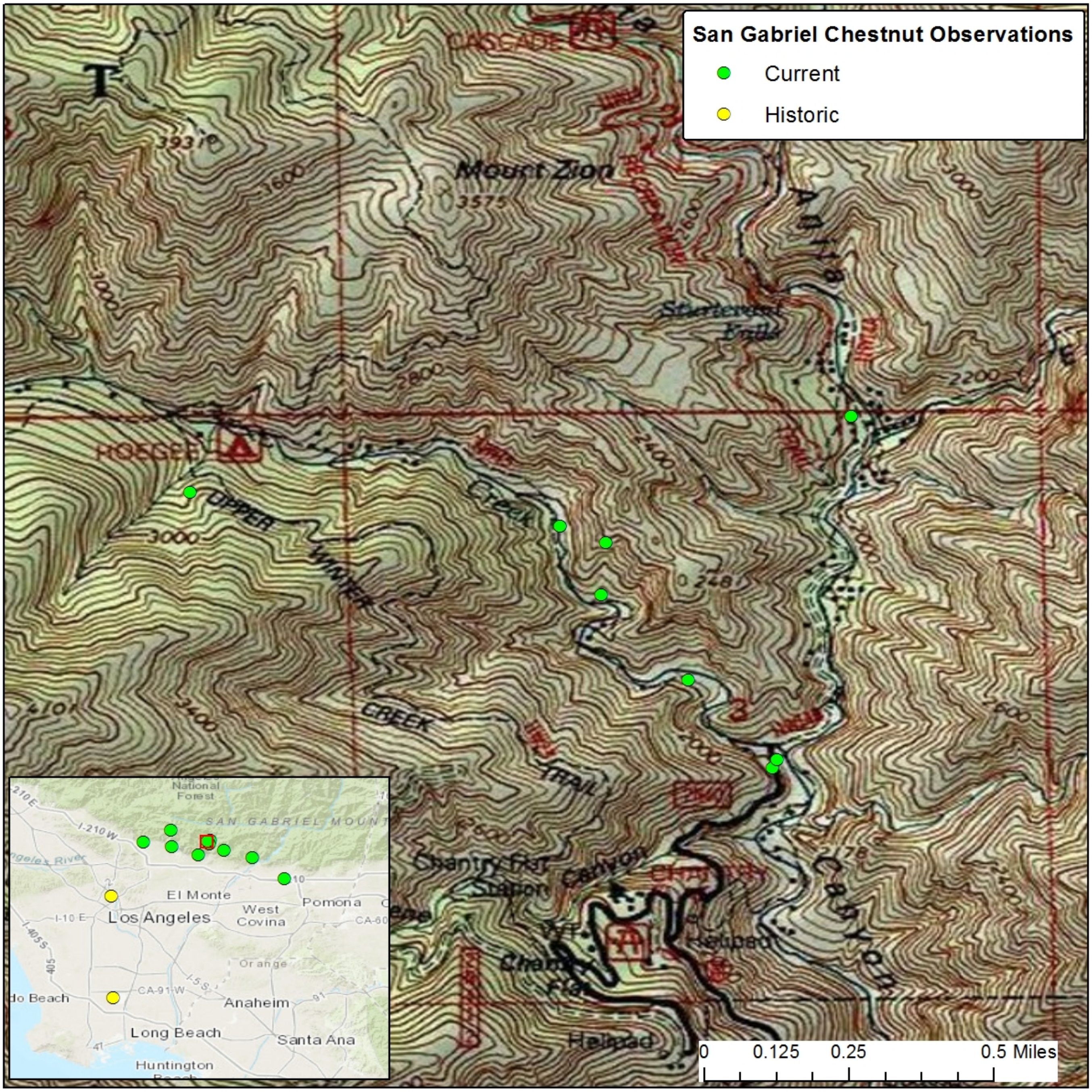

Figure 5 Recreational developments in San Gabriel chestnut snail habitat include campgrounds, picnic areas, and trails, bringing millions of visitors in proximity to the rare snail with no measures in place to safeguard its habitat.

Overutilization

Overexploitation is not a documented threat to the San Gabriel chestnut snail at this time. Due to its restricted distribution and slow population growth, however, care should be taken to avoid overcollection as conservation interest in this species increases. Smith (1970) cautions:

> [T]he relatively few collectors especially interested in land mollusks at present are not liable to endanger a species; but this may not be so true in the future. There is an ever-present danger from the over-collecting of some forms having an extremely limited distribution or living in micro-habitats not occurring anywhere else. Danger to such forms can and should be minimized in the interests of science. Land snail collectors can reduce this danger if they will operate with discretion, with a weather eye on the need to allow a race or a colony to perpetuate itself (p. 40).

Sullivan (1997) cautions that surveying for land snails should be executed carefully and strategically because substrate disturbance for sampling efforts can have unintended negative effects on snail habitat and populations: "indiscriminate sampling can significantly and adversely impact local land snail populations over the long-term," (p. 24).

Disease and Predation

Disease is not a documented threat to the San Gabriel chestnut at this time.

Though predation on the San Gabriel chestnut has not been studied specifically, Cox (1982) identifies predation as one of the primary causes of mortality for the most closely related species, *Glyptostoma newberryanum,* by rodents in particular (p. 10). Nordsieck (undated) reports that animals that eat snails can be found in almost every systematic group as snails are largely defenseless and are an easy supply of protein for many animals, particularly when other food sources are in meagre supply. Snail eggs are also consumed by many small animals, including other snails, and hatchling snails are consumed by various insects (Nordsieck undated). Known terrestrial snail predators include ants, beetles, arachnids, flies, snails, worms, birds, amphibians, reptiles, and mammals (Nordsieck undated; Sullivan 1997, p. 27; Burke 2013, p. 20; Vendetii 2016).

Several harmful invasive mollusk species are established in the Los Angeles area (Vendetii 2016). The brown garden snail (*Cornu asperum*) was intentionally introduced into California in the 1850s as a human food source, and is now found throughout the state in both urban and rural environments. The decollate snail (*Rumina decollata*) was intentionally released into Southern California citrus orchards to eat the brown garden snails that were harming citrus crops, but the decollate snail spread and is now a documented predator of endemic and endangered snail species (Vendetti 2016).

Other Factors Affecting Its Continued Existence

Climate Change

The San Gabriel chestnut snail is threatened by climate change. Anthropogenic climate change is having a significant impact on physical and biological systems globally (Rosenzweig et al. 2008, p. 353). Climate change impacts have now been documented across every ecosystem on Earth (Scheffers et al. 2016, p. 719). The future global extinction risk from climate change is predicted not only to increase but to accelerate as global temperatures rise (Urban 2015, p. 571).

The American Southwest, including southern California, is getting hotter and drier (Vose et al. 2017, pp. 186-190; Easterling et al. 2017, pp. 207-209). Annual precipitation has decreased in southern California, particularly in spring (Easterling et al. 2017, pp. 207-209, Figure 7.1). Surface soil moisture has also decreased because of higher evapotranspiration as temperatures rise (Wehner et al. 2017, p. 231). Spring snow cover, which is important for water supply in the San Gabriel Mountains, is also declining, and spring snowmelt and associated runoff are occurring earlier (Easterling et al. 2017, pp. 207, 209, 210).

Climate models project that precipitation and soil moisture in the Southwest, including southern California, will continue to decrease (Easterling et al. 2017, p. 217; Wehner et al. 2017, pp. 231, 238). Winter and spring snowpack is also projected to continue to decline, as more precipitation falls as rain instead of snow, coupled with earlier spring snowmelt (Sun et al. 2016; Wehner et al. 2017, pp. 231, 239, 240). Importantly, with continued warming, there will likely be a greater frequency and magnitude of agricultural drought (characterized by low soil moisture during the growing season) as evapotranspiration exceeds precipitation (Wehner et al. 2017, p. 237).

Bogan et al. (2014) predict that the extreme droughts that will occur more frequently in the Southwest will lead to the extinction of vulnerable invertebrate species (p. 9). Indeed, this is already occurring as Hershler et al. (2014) have documented the recent extinctions of endemic springsnail species in the Chihuahuan Desert (p. 47).

The life history of land snails is strongly controlled by climate (Frest and Johannes 1997, p. 28). As sedentary animals that are dependent on moist microhabitats, desert land snails are undoubtedly threatened by the drying of their environment (Muller et al. 2009, p. 90). As species with restricted ranges, snails are particularly vulnerable to extirpation from climate change (Parmesan 2006, Urban 2015). Because the San Gabriel chestnut snail's small range is surrounded by unsuitable habitat conditions, snails will not be able to redistribute themselves in response to climatic changes and will thus face an increased risk of extinction.

As the North American climate has changed through geologic time, land snails have become isolated thus promoting the diversification of species (Roth 1981, p. 401-403; Weaver et al. 2010, p. 2). The rich mollusk fauna that diversified in climate refugia zones such as mesic northern Idaho (Burke and Leonard 2013), the Arizona Sky Islands (McCord et al. 1994), and the northern Chihuahuan Desert (Sullivan 1997, p. 11) is evidence that terrestrial mollusks are prone to extirpation due to climate change. The San Gabriel chestnut snail is likely a descendant of species that were more widespread in the Pleistocene and earlier when the climate was cooler and wetter.

The use of snail shells to analyze past climate conditions is further evidence that the survival of terrestrial snail species is dependent upon suitable climactic conditions. Goodfriend (1990) used the isotopic composition of land snail shell organic matter to reconstruct paleoclimate history from the Middle East. The author was able to infer rainfall conditions in the Negev Desert of southern Israel extending back 6500 years using snail shells (Goodfriend 1990, p. 186). More recently, Yanes et al. (2014) used isotopes from terrestrial snail shells to infer average and seasonal late Holocene environmental conditions in central Argentina.

The direct studies on climate change and snails that are available do in fact show that land snails are very susceptible to extirpation from climate change impacts (Nevo et al. 1981, Gerlach 2007, Muller et al. 2009, Moreno-Rueda 2012, Baur and Baur 2013, Pearce and Paustian 2013).

Moreno-Rueda (2012) found that weather is one of the prime determinants of activity patterns in snails and that moisture was the single most important determinant of activity in land snails in arid environments in southeast Spain. He predicts that decreased wetness and rising temperatures in the study area will narrow the seasonal activity period, extend the aestivation period, and have negative consequences for snail survival necessitation conservation measures to prevent snail extinction.

Nevo et al. (1981) examined allozymic variation in proteins in the desert landsnail *Trochoidea (Xerocrassa) seetzenii* in comparison to variable desert climatic background conditions and found that the pattern of genetic variation suggests that climatic selection plays a major role in allozymic and morphological population structure and differentiation for desert snails (p. 199). Further, they conclude that climate greatly affects snail survival and life history:

> Climatic selection has been shown to affect both regional (Nevo and Bar 1976; Nevo etal. 1981b) and local (Nevo et al 1981 a) patterns of genetic differentiation of population structure in landsnails. These studies show strong association between gene frequencies of allozymic variation and climatic factors, primarily those related to water availability and secondarily to temperature. The climatic factors appear to shape adaptively, at least partly, allozymic and morphological variations. Similarly, climatic selection has an important effect on visual genetic polymorphism in snails (Jones 1973; Bar and Nevo 1976) in combination with additional factors such as predation, population density, etc (Jones et al. 1977). The relative importance of the various mechanisms and forces appears to vary from population to population in the landsnail Cepea (Jones et al., op. cit.) where unique explanations are needed for almost every

> Cepea population. Jones et al. (1977) claimed therefore that it is not possible to produce general rules from detailed studies of few populations. While this may be true for any realistic explanatory evolutionary biology model, **the substantial importance of climatic selection in genetic population structure of landsnails seems undeniable**. Allozyme and visual polymorphisms far from being largely neutral, appear to provide the basis for adaptive evolution (p. 207, emphasis added).

Gerlach (2007) reported the extinction of the Aldabra banded snail (*Rhachistia aldabrae*) due to modern climate change, though a small population has since been rediscovered and the snail is critically endangered rather than extinct.

Müller et al. (2009) modeled the occurrence and distribution of mollusks in a low mountain range national park in Europe under two climate warming scenarios and predicted a decrease in the occurrence and abundance of high elevation mollusk species due to global climate change (p. 89). The model predicted that the terrestrial snail species *Semilimax kotulae* would probably be extirpated in the study area due to climate change (Muller et al. 2009, p. 89).

Pearce and Paustian (2013) examined whether snail populations currently confined to cooler habitats at higher elevations in Pennsylvania might decline or be eliminated if their ranges are reduced upward by climate warming. They predict that five land snail species could decline due to range reduction resulting from climate warming, and that one species, the flamed tigersnail (*Anguispira alternata*), could be extirpated (p. 219). In the following passages they explain expected impacts of climate change on snails:

> Climate warming could threaten snails through elevational or latitudinal effects. Elevationally, populations currently confined to mountaintops (habitat islands) might perish if the climate warms and they cannot move higher to cooler conditions. Latitudinally, slow-moving land snails may be unable to disperse rapidly enough to stay within their shifting habitats. Other climate warming threats not addressed in this paper could include movement into the area by other species (predators, parasites, diseases, or competitors), latitudinal shifts in range of the biota or its host organisms (e.g., food or symbionts), and changes in precipitation, all of which are certainly expected from climate warming models (p. 213).

> Another direct effect of climate change that will likely affect land snails is changes in rainfall. Changes in rainfall are a great concern because snails need moisture. The first species extinction attributed to climate change is a land snail whose extinction is attributed to reduced rainfall that increased mortality of juveniles (Gerlach 2007). Climate change related alterations in precipitation will likely affect land snails in Pennsylvania. As habitats shift pole-ward due to climate warming, we can expect snails to be affected more than many other organisms due to their limited dispersal ability. Furthermore, human modifications such as

> fragmentation of habitats would make movement in response to climate change more difficult (p. 219).

Baur and Baur (2013) found evidence that a land snail species has already considerably extended its distribution towards higher elevations in the past nine decades most probably as a result of climate warming. They investigated changes in the upper elevational limit of the land snail *Arianta arbustorum* in the Swiss Alps by comparing records from 1916 and 2011. They found that the upper elevational limit for snail populations has risen, on average, by 164 m in 95 years, accompanied by a 1.6 °C rise in mean annual temperature in the study area. Further, they found that in some areas the snails have already reached natural dispersal barriers such as vertical rock walls with no soil, preventing any farther upward dispersal (Baur and Baur 2013, p. 596). Their conclusions underline the threat posed to the San Gabriel chestnut by climate change:

> Species are more likely to change their distribution in response to climate warming than to adapt to higher temperatures in situ, because current climate warming may be too fast for genetic adaptation to occur (Bradshaw and Holzapfel 2006). Therefore, the number of local extinctions will depend strongly on species' capacities to change their distribution (Moreno-Rueda et al. 2012). Low dispersal ability of species and geographic barriers to movement are likely to increase extinction risk for some species (Akçakaya and Baur 1996). It has been suggested that terrestrial gastropods with poor dispersal ability are particularly vulnerable to climate warming (Müller et al. 2009) (p. 598).

It is reasonable to conclude that the San Gabriel chestnut snail is threatened by climate change due to its specific microhabitat requirements, limited dispersal ability, and highly restricted range. The research on climate change impacts to land snails indicates that extirpations have already occurred and more are expected to occur.

Population Isolation

Highly endemic terrestrial gastropods tend to occur in limited and isolated populations in small areas of suitable habitat because they are "confined to a specific set of conditions as the plant community, slope, aspect, soil condition, or geology changes" (Burke 2013, p. 17). Reaching new habitats or recolonization of disturbed habitats following habitat degradation is especially challenging for land snails because they have small home ranges and cannot cross unsuitable habitat conditions (Burke 2013, p. 17). Because of their specific habitat requirements and life-history traits, endemic land snails are at increased risk of loss of genetic variation when habitat is disturbed and populations become isolated (Sullivan 1997, p. 25). Habitat fragmentation can thus lead to population extirpation and eventual species extinction (Sullivan 1997, p. 10, 25). The range of the San Gabriel chestnut snail is highly fragmented by development and populations in urbanized areas have been lost. It is imperative for the long-term viability of the species that protections are put in place for remaining populations.

Inadequacy of Existing Regulatory Mechanisms

Currently there are no regulatory mechanisms in place to protect the San Gabriel chestnut snail.

The snail is included on the California Natural Diversity Database Special Animals List, but this provides no protection for its habitat.

The San Gabriel chestnut snail occurs in a few populations on private lands but primarily survives on the Angeles National Forest. The U.S. Forest Service does not have any procedures in place to survey for the snail or manage its habitat. It is not included in the invertebrate animal species-at-risk viability assessment in the Final Environmental Impact Statement of the Land Management Plan for the Angeles National Forest (USDA Forest Service 2005, p. 385). There is no mention of the species at all in the Forest Management Plan. It is not on the Forest Service Sensitive Species list.

Because terrestrial mollusk populations have low mobility and low recolonization potential following habitat degradation, their long-term persistence depends on managing for the survival of existing colonies (Burke et al. 1999, p. 8).

It cannot be assumed that occurrence on national forest land alone is sufficient to safeguard the San Gabriel chestnut snail without specific management in place to protect the habitat areas where it occurs. Without additional specific safeguards to survey and manage for rare species, land management practices of public land management agencies are generally inadequate to prevent the extinction of endemic species (Frest and Johannes 1997, p. 33). Because resource agencies generally have no baseline information for endemic land snail populations, lack of management planning for rare species can lead to population extirpation and species' extinction (Sullivan 1997, p. 9-10).

With protection and appropriate habitat management, the San Gabriel chestnut snail can be saved. In 1989, the U.S. Fish and Wildlife Service protected the Magazine Mountain shagreen snail *(Inflectarius magazinensis*) under the Endangered Species Act due to anticipated negative effects of construction and recreation associated with development in a state park in the Ozark Mountains in Arkansas. The Service cautioned that a wide array of activities could adversely affect the snail unless they were planned and conducted with protection of the snail's limited habitat in mind (USFWS 1989, p. 15206). After sufficient measures were put in place to safeguard its habitat, it was delisted due to recovery in 2013. The listing and recovery of that snail provides an example of both the threats that land snails face on public lands and of how they can be successfully conserved when specific measures are put into place to protect their habitat.

MANAGEMENT RECOMMENDATIONS

Because of the threats to its survival and the lack of mechanisms in place to protect it, the San Gabriel chestnut snail warrants protection under the Endangered Species Act. The Angeles National Forest should develop specific guidance for the protection and management of this rare mollusk and it should be added to the U.S. Forest Service Sensitive Species list. All known locations should be protected, buffered, and appropriately managed.

Existing occupied sites should be protected from all activities that would alter microsite characteristics, including buffer areas large enough to moderate fluctuations in humidity, temperature, and other environmental characteristics of critical importance to terrestrial mollusks. Care should be taken to maintain refugia such as downed wood and debris piles.

Native plant communities should be maintained around occupied sites to provide shade, food sources, and substrates for fungi. Care should be taken to avoid soil compaction and maintain vegetative litter.

Pesticides and herbicides should not be applied in or near snail habitat.

Educational signs should be installed and site closures should be considered to protect the San Gabriel chestnut snail from recreational impacts on the Angeles National Forest.

CONCLUSION

The San Gabriel chestnut snail warrants protection under the Endangered Species Act and the U.S. Fish and Wildlife Service should immediately issue a positive 90-day finding for the species and undertake an official status review leading to a proposal for listing within 12-months.

The San Gabriel chestnut snail is an important component of the biodiversity and natural heritage of Southern California. Ecosystems are made up of all the components that keep natural processes functioning, and the loss of an individual species and the contributions it makes to natural processes disrupts the balance of nature and reduces ecosystem resiliency (Burke 2013, p. 12). Mollusks in particular play a very important role in the balance of nature by consuming liter, recycling nutrients, and forming a vital link in the food web (Burke 2013, p. 13).

The presence of the San Gabriel chestnut snail, a fragile little animal dependent on moist environments, in the mountains of Southern California tells the story of a wilder past when natural habitats were more connected. It is important to save this unique animal that is found in the San Gabriel range and nowhere else on Earth because it preserves an irreplaceable piece of the past and harbors the genetic potential for the unique wildlife species that will evolve into the future.

REQUEST FOR CRITICAL HABITAT DESIGNATION

Petitioners urge the Service to designate critical habitat for the San Gabriel chestnut snail concurrently with listing. Critical habitat as defined by Section 3 of the ESA is: (i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species. 16 U.S.C. § 1532(5).

Congress recognized that the protection of habitat is essential to the recovery and/or survival of listed species, stating that: classifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence… If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat. H. Rep. No. 94-887 at 3 (1976).

Critical habitat is an effective and important component of the ESA, without which the San Gabriel chestnut snail's long-term chance for survival diminishes. Petitioners thus request that the Service propose critical habitat for this rare snail concurrently with its proposed listing.

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Appendix: Notice to California in accordance with the September 27, 2016 Final Rule on Revisions to Regulations for Petitions (81 FR 66462)

CENTER *for* BIOLOGICAL DIVERSITY — *Because life is good.*

January 12, 2017

To: California Department of Fish and Wildlife
Charlton Bonham, Director
Director@wildlife.ca.gov

CC: Betty.Courtney@wildlife.ca.gov
Kelly.Schmoker@wildlife.ca.gov
Scott.Harris@wildlife.ca.gov
Victoria.Chau@wildlife.ca.gov
Chris_Dellith@fws.gov
Mendel_Stewart@fws.gov
Gary_Frazer@fws.gov

Dear California Department of Fish and Wildlife and U.S. Fish and Wildlife Service:

I am writing to inform you that the Center for Biological Diversity is concerned about the survival of the San Gabriel Chestnut Snail (*Glyptostoma gabrielense*), a Los Angeles County endemic whose limited habitat is imminently threatened by development.

As a courtesy, I am writing to notify you that we plan on filing a petition under the California Endangered Species Act seeking state protection for the snail. We plan on filing the state petition as soon as possible.

Additionally, and pursuant to 50 C.F.R. § 424.14(b), we hereby provide notice that the Center for Biological Diversity intends to file a petition under the federal Endangered Species Act to list and designate critical habitat for the San Gabriel Chestnut Snail (*Glyptostoma gabrielense*) no sooner than 30 days from the date that this notice is provided.

Please feel free to contact me for more information.

Sincerely,

Tierra Curry
Senior Scientist
PO Box 11374
Portland, OR 97211
928-522-3681
tcurry@biologicaldiversity.org

Tierra Curry

From:	Tierra Curry <tcurry@biologicaldiversity.org>
Sent:	Thursday, January 12, 2017 1:20 PM
To:	Director@wildlife.ca.gov; Betty.Courtney@wildlife.ca.gov; Kelly.Schmoker@wildlife.ca.gov; Scott.Harris@wildlife.ca.gov; Victoria.Chau@wildlife.ca.gov; Chris_Dellith@fws.gov; Mendel_Stewart@fws.gov; Gary_Frazer@fws.gov
Cc:	tcurry@biologicaldiversity.org
Subject:	Notice of Intent to File Listing Petitions for the San Gabriel Chestnut Snail
Attachments:	San Gabriel Chestnut 30 Day Federal Notice.pdf

Dear California Department of Fish and Wildlife and U.S. Fish and Wildlife Service:

Attached please find a letter indicating the intention of the Center for Biological Diversity to file scientific petitions seeking state and federal protection for the San Gabriel Chestnut Snail.

Sincerely,
Tierra

Tierra Curry
Senior Scientist
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